

EXHIBIT B

**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF MICHIGAN**

MRP PROPERTIES COMPANY, LLC,
VALERO REFINING COMPANY –
OKLAHOMA, VALERO REFINING
COMPANY – TENNESSEE, L.L.C.,
THE PREMCOR REFINING GROUP INC.,
VALERO REFINING – TEXAS, L.P.,
and ULTRAMAR INC.,

Plaintiffs,

v.

UNITED STATES OF AMERICA,

Defendant.

No. 1:17-cv-11174-TLL-PTM

AFFIDAVIT OF ALFRED (A. J.) GRAVEL

Alfred Gravel, being duly sworn, deposes and says:

1. My name is Alfred M. Gravel (a.k.a. A. J.). I am over eighteen (18) years of age and I reside at 11603 Danville Drive, North Bethesda, Maryland, 20852. I have personal knowledge of the facts set forth in this affidavit and am competent to testify to them if necessary.

2. I am a Senior Managing Director at FTI Consulting, Inc. (“FTI”), a global business advisory firm. I am co-leader of the Environmental Solutions practice and also lead the Forensic History and Analysis group. In my roles at FTI

and in other professional experience dating back to 1995, I have provided forensic historical research and environmental cost analysis services to corporations, joint defense groups, and public sector clients. My educational background, work experience, publications and prior testimony are truly and correctly presented in my resume provided as **Exhibit B-1**.

3. FTI is being compensated at the hourly rate of \$390.00 for my work on this matter.

4. In the course of my work over the past 20 years I have been retained by at least 5 major oil companies to research and document the role of the Federal government in the operation of the oil industry, and particularly the operation of refineries, during World War II (“WWII”). I have served as a consulting and/or testifying expert in legal matters involving about 30 oil refineries operating before, during and after WWII, twelve of which are now at issue in this matter.

Scope of the Assignment

5. I have been retained by Valero Services, Inc. (“Valero”) to conduct historical research and perform analyses relating to the activities of the Federal government during WWII relating to the petroleum refining industry in general and at certain petroleum refineries (collectively referred to in this affidavit as “the refineries”) known as the:

- 1) Bell Ardmore Refinery
- 2) Caminol Hanford Refinery

- 3) Caminol Santa Fe Springs Refinery
- 4) Delta Memphis Refinery
- 5) Eastern States Houston Refinery
- 6) Gulf Port Arthur Refinery
- 7) Kanotex Arkansas City Refinery
- 8) Leonard Alma Refinery
- 9) Mid-West Alma Refinery
- 10) Roosevelt Mt. Pleasant Refinery
- 11) Vickers Potwin Refinery
- 12) Worth Blue Island Refinery

6. For my work related to the refining industry and each of the refineries, I and my staff have conducted research in published documents and public and/or business records normally relied on by experts in my field. To date, the materials collected for this matter were obtained from Valero and various libraries, archives and repositories, including, but not limited to National Archives and Records Administration facilities in College Park, Maryland, Kansas City, Missouri, and Ft. Worth, Texas; the Library of Congress; Kansas Department of Health and Environment; and, Central Michigan University. Collected and cited documents include primary source materials contemporaneous with the operations of the refineries as well as secondary source materials. For instance, contemporary trade literature for the WWII-era petroleum industry, such as *Oil and Gas Journal*, *Petroleum Refiner*, and *National Petroleum News*, and the official history of the Petroleum Administration for War for the period 1941-1945, published in 1946 by the U.S. Government Printing Office, were also examined.

Findings Summary

7. The collection and analysis of the materials identified to date was conducted using an established historical methodology. My current findings are based on a large body of documentation. I have provided sample materials cited in support of this affidavit to illustrate my current findings which fall broadly into four main categories:

(1) The President of the United States established a wartime agency that came to be known as the Petroleum Administration for War (“PAW”) which was tasked with, in the words of Charles E. Wilson, executive vice chairman of the War Production Board (“WPB”), “*nothing less than the responsibility for victory.*”¹ WWII was a war of oil.² [Emphasis in the original]

(2) To fulfill its mandate, the PAW “direct[ed] the activities of all domestic refineries so as to obtain essential petroleum requirements, both military and civilian.”³ As described by A. P. Frame, director of PAW’s Refining Division to the United States Senate in November 1945, under PAW direction, “[t]he small refiners as well as the larger ones [were] required to utilize their productive capacity to the maximum.”⁴ Further, the petroleum refining industry “had in effect been operated as if its various refineries were component parts of one huge Nation-wide refinery.”⁵

(3) The PAW exerted its control over the nation’s refineries, large and small, in part through granting or withholding crude oil supplies which it allocated

¹ Attached hereto as Exhibit B-2 is a true and correct copy of an excerpt from John W. Frey and H. Chandler Ide, *A History of the Petroleum Administration for War: 1941-1945*, U.S. Government Printing Office, Washington, DC, 1946, at 1.

² See Ex. B-2, at 1.

³ Attached hereto as Exhibit B-3 is a true and correct copy of an excerpt from *Wartime Petroleum Policy under the Petroleum Administration for War*, hearings before a special committee investigating petroleum resources, United States Senate, 79th Congress, 1st Session, November 28, 29 and 30, 1945, at 133.

⁴ Ex. B-3, at 133.

⁵ Ex. B-3, at 137.

on a monthly basis to individual refineries. These crude oil allocations were based on PAW's decisions as to what products or product components each refinery would make and to whom those products would be sold or transferred, always with the primary goal of maximizing overall war production. Again, in the words of A. P. Frame, PAW Refining Division director, "[i]n May 1942 the first Government action affecting the whole refining industry was taken. At that time a program for the operation of refineries as to their crude runs and products yields was formulated in order to balance crude-oil supplies and available transportation with military and essential civilian requirements."⁶ [Emphasis added]

(4) The PAW, acting as the claimant agency for the petroleum industry in dealing with the WPB, controlled the materials priorities required to obtain equipment and supplies needed for refinery repairs, maintenance and/or improvements, including those needed for waste handling facilities. The exigencies of wartime materials shortages made it necessary for the WPB to set strict standards for the approval of refinery projects based mainly on whether they were essential to war production.⁷

8. These four broad, program-level Federal government controls over the petroleum refining industry affected all of the refineries addressed in this matter.⁸ Even though the refineries were located in different PAW districts, the impact of Federal government controls on each of them is a common theme which binds them together.

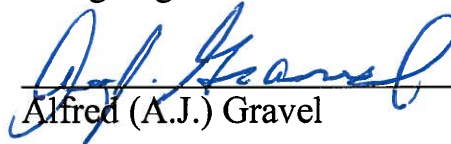
⁶ See Ex. B-3, at 133.

⁷ Attached hereto as Exhibit B-4 is a true and correct excerpt of George L. Parkhurst, PAW Assistant Director of Refining, Letter to Carlton J. Everett, PAW Director of Refining, District 1, November 6, 1944.

⁸ These four broad categories of Federal Government control over the petroleum refining industry during WWII are not necessarily exhaustive of all of the types of Government control or involvement exercised; rather, they were selected to illustrate the commonality among the refineries in this matter.

9. Based upon my previous work and analysis of the records collected in this matter, it is clear that there are many commonalities among these refineries, especially vis-à-vis the nature, extent, and pattern of the Federal government's control of them during WWII. Given these commonalities and the nature of these types of investigations, I anticipate that the content of my testimony and supporting exhibits will in many respects be similar for each of the refineries at issue in this matter. As a result, if I had to testify about these sites in separate court cases I would be forced to repeat much of my testimony in each case and be prepared to discuss in each case what I testified in the other cases. It would be far more efficient, practical, and convenient for me to testify in one court case, and it would be inefficient, costly, and unduly burdensome for me to prepare for and appear in multiple court cases.

I declare under penalty of perjury that the foregoing is true and correct.


 Alfred (A.J.) Gravel

STATE OF MARYLAND §
 §
 COUNTY OF MONTGOMERY §

SUBSCRIBED AND SWORN TO BEFORE ME this 22nd day of
 September, 2017.



Notary Public in for
 The State of Maryland

MOIRA J. SUNTUM
 Notary Public-Maryland
 Montgomery County
 My Commission Expires
October 19, 2019

EXHIBIT B-1

A.J. Gravel

Senior Managing Director – Environmental Solutions

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Suite 375
Rockville, MD 20850
Tel: +1.301.591.8014

PROFESSIONAL AFFILIATIONS

American Bar Association
(Associate Member,
Environment and Natural
Resources Section)

American Society of
Environmental History

Environmental Law Institute

National Council on Public
History (NCPH)

EDUCATION

B.S. in Health Sciences,
Springfield College, Springfield,
MA

Master of International
Business Management,
University of Maryland,
University College

PROFESSIONAL SUMMARY

Mr. Gravel is a Senior Managing Director in FTI Consulting Inc.'s (FTI) Forensic Litigation and Consulting segment. He is the co-practice leader of the Environmental Solutions Practice and heads the Forensic History and Analysis group. Mr. Gravel is based in the Washington DC area and has over twenty years combined experience as a consultant and expert witness. He has managed the execution of over 100 environmental, products liability, and litigation support projects and has provided testimony as a fact witness, Rule 30(b)(6) corporate designee and expert witness.

Mr. Gravel's primary areas of expertise include forensic history, environmental cost recovery and cost analysis. He has experience assisting clients with the recovery of costs under CERCLA and in that area has provided services such as: Potentially Responsible Party (PRP) identification; Federal PRP claims; site history reconstruction; corporate succession and asset searches; waste-in database development; cost allocation analysis; cost claim package development and/or validation; environmental cost estimation; and National Contingency Plan (NCP) analysis. Mr. Gravel has used forensic history and cost analysis techniques to address issues in environmental, toxic tort and product liability matters. Examples of the types of analyses conducted relating to these matters include: past industrial waste generation and disposal; Natural Resource Damages (NRD) baseline investigations; cost allocation development and settlement negotiation support; mergers and acquisitions due diligence analysis; land use and business operations histories; alternate causation and standard-of-care analyses; and industry practices studies.

Mr. Gravel's experience includes work on a variety of sites, including former and/or currently operating facilities, urban waterways, contaminated groundwater plumes and industrial and municipal (permitted and unpermitted) landfill sites. His industry experience includes work with the mining and smelting; petroleum refining; chemicals; shipbuilding, ship conversion and scrapping; electric and gas utilities; and manufacturing sectors. Mr. Gravel has worked on cases national and international in scope and multi-jurisdictional cases. He performs work for a diverse clientele that includes private and public sector entities and joint defense groups.

REPRESENTATIVE ENGAGEMENTS

Expert and Rule 30(b)(6) Witness Assignments

Cyprus Amax Minerals Company v. TCI Pacific Communications, Inc. In this matter Mr. Gravel was retained by Cyprus Amax Minerals Company to conduct research, perform analysis and provide expert opinions relating to: 1) the historic operations of two primary zinc horizontal retort smelters in Collinsville, Oklahoma; whether response actions taken by Cyprus were consistent with the National Contingency Plan ("NCP"); and whether the costs incurred were necessary costs of response and complied with the Cost Documentation and Cost recovery provision (§300.160(a)) of the NCP.

The United States of America v. Cornell Dublier Electronics, Inc. and Home Insurance Company v. Cornell Dublier Electronics, Inc. Mr. Gravel was retained by a corporate entity, London Market Insurers and CNA to conduct a PRP investigation to identify possible contributors to PCB contamination present in sediments in a watercourse located proximate to a former Cornell Dublier Electronics, Inc. site in New Jersey; he also addressed the adequacy of PRP investigation activities undertaken by USPEA and Cornell Dublier.

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Georgia-Pacific LLC v. OfficeMax Incorporated and Boise Cascade, LLC. Mr. Gravel was retained by counsel for the plaintiff to conduct analyses and provide opinions relating to a former lumber mill site located in California. His analyses focused on, the evaluation of the response actions taken at the Site and their substantial compliance with the applicable provisions of the National Contingency Plan (“NCP”) for cost recovery purposes, and the development of a cost allocation framework for the Court’s consideration in determining the appropriate equitable allocation of response costs among the parties to the litigation.

Florida Power Corporation v. First Energy Corp. Mr. Gravel was retained to conduct historical research, perform related analysis and present opinions relating to, the operations of two manufactured gas plants (“MGPs”) and their relationship to a utility system holding company, the use of management service contracts as a means of domination and control over the MGPs, and the identification and evaluation of the parties responsible for day-to-day operational decisions relating to the storage and disposal of hazardous wastes generated at the two MGPs at issue in the litigation.

ExxonMobil Corporation v. United States of America. Mr. Gravel was retained to conduct historical research, perform related analysis and present opinions relating to the federal government’s involvement in the petroleum industry in general, and in two refineries in particular, from 1941 to 1955. He was also asked to opine on the federal government’s nexus to contamination at the facilities and to compile and perform cost recoverability analyses, including validation of response costs in compliance with the NCP.

Betty Jean Cole, et al. v. ASARCO Incorporated et al. and Sammy Beets, et al. v. Blue Tee Corp. et al. Mr. Gravel was retained to conduct historical research, perform related analysis and present opinions relating to the federal government’s involvement in mining, milling and related activities in the Picher Field; historical mining and milling operations of the corporate predecessors of Blue Tee Corporation and Gold Fields American Industries in the Oklahoma portion of the Tri-State Lead and Zinc District; chat generation and use as a salable product; and the role of municipal entities in the dispersal of chat throughout the Picher Field.

The Quapaw Tribe of Oklahoma (O-Gah-Pah) v. Blue Tee Corporation, et al. In connection with litigation relating to a Natural Resource Damages (“NRD”) claim, Mr. Gravel was retained to conduct historical research, perform related analysis and present opinions regarding the federal government’s involvement in mining, milling and related activities in the Picher Field; its involvement with, and awareness of, mine and surface cave-ins and collapses over time; and the historical operations of the defendants’ alleged predecessors in the Picher Field.

New York State Gas & Electric Corporation v. FirstEnergy Corp. Mr. Gravel was retained to conduct historical research, perform related analysis and to present opinions related to the development and roles of certain public utility holding and management service companies as they related to the operational management of 18 manufactured gas plants located in the State of New York.

The Quapaw Tribe of Oklahoma (O-Gah-Pah) v. Blue Tee Corporation, et al. Mr. Gravel was retained to provide Rule 30(b)(6) testimony on the historical mining and milling operations of the corporate predecessors of Blue Tee Corporation and Gold Fields American Industries in the Oklahoma portion of the Tri-State Lead and Zinc District as well as corporate knowledge and awareness of certain other topics relating to potential NRD issues.

Moraine Properties, LLC v. Ethyl Corporation. Mr. Gravel was retained to provide opinions related to whether the plaintiff undertook reasonable operational practices with regard to its management of wastewater treatment sludge, including identifying and addressing PCB issues; and whether the response actions taken and associated environmental costs incurred by the plaintiff were necessary costs of response incurred in substantial compliance with the applicable requirements of the NCP and resulted in a CERCLA-quality cleanup. Mr. Gravel was also retained to examine Ethyl Corporation’s historical operations as they related to a paper mill site and to provide Rule 30(b)(6) testimony on specific topics related to those operations.

Evansville Greenway and Remediation Trust v. Southern Indiana Gas and Electric Company, Inc., et al. Mr. Gravel was retained to provide opinions related to environmental cost recoverability, including whether the response actions performed, and associated costs incurred by the plaintiff, were in substantial compliance with the applicable requirements of the NCP and resulted in a CERCLA-quality cleanup.

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Innis Arden Golf Course v. Pitney Bowes, Inc. et al. Mr. Gravel was retained to provide opinions related to cost recoverability, including whether the response action and associated costs incurred by the plaintiff were in substantial compliance with the applicable requirements of the NCP and resulted in a CERCLA-quality cleanup.

Price v. Price. Mr. Gravel was retained to evaluate the cost impacts of a United States Environmental Protection Agency (USEPA) Consent Judgment for a landfill in New York, and to determine the effect of the pending Consent Judgment on the ability a real estate appraiser to perform an accurate valuation of the landfill.

BNSF Railway Company v. The Doe Run Resources Corporation, et al. Mr. Gravel was retained to provide opinions on the regulatory development of the Hazardous Materials Transportation Act as it related to the transport of specific commodities; the nature and extent to which lead-containing materials were used by the railroad in the course of its operations over time, and identification of anthropogenic sources of lead that could have potentially contributed to contamination along tracks and in rail yards.

Jersey City Municipal Utilities Authority v. Honeywell International, Inc. Mr. Gravel was retained to present opinions related to the historical operations of the Jersey City Municipal Authority and Jersey City Incinerator Authority from 1910 to the present and related to environmental cost allocation.

In re: Dana Corporation, et al. In this bankruptcy proceeding, Mr. Gravel was retained to perform several tasks including: 1) analyzing the federal government's historical role in the operations of a former capacitor manufacturing facility and its potential contribution to contamination for which cleanup costs were claimed; 2) quantifying environmental response costs and evaluating indirect and oversight costs and discount rates; 3) quantifying the claim of the NRD Trustees; and 4) performing environmental cost allocation analysis to develop the Debtor's net cost share percentage of claimed costs. Mr. Gravel also provided Rule 30(b)(6) testimony in this matter.

Perrine et al. v E.I. DuPont de Nemours and Company et al. Mr. Gravel was retained to provide opinions related to the historical operations of the facility and the identification of anthropogenic sources that may have contributed to contamination in the class area over time.

Tonya Lee Drummond et al. v. E.I. DuPont de Nemours and Company et al. Mr. Gravel was retained to provide opinions related to historical standard-of-care and the appropriateness of landfill practices with regard to disposal of smelting residues.

Disabled in Action of Pennsylvania v. Southeastern Pennsylvania Transportation Authority. Mr. Gravel was retained to conduct an investigation and render an opinion related to the history, development, growth and character of land use in the Penn Center and Suburban Station area of downtown Philadelphia from 1890 through 2005.

Bill and Jackie Holder, et al. v. Gold Fields Mining Corporation, et al. Mr. Gravel was retained to conduct a historical investigation and render opinions related to mining and milling techniques; the role and influence of the federal government on mining activities and methods; whether chat, tailings and other mining by-products were/are saleable products that possess commercial value; the state of knowledge regarding the toxic effects of lead in chat, tailings and surface dust; the role of local state and federal public works projects in the dispersal of chat in the Tri-State Lead and Zinc District; and the total amount of crude ore mined by the defendants' alleged predecessors as a percentage of the total production for Ottawa County, Oklahoma.

Jimmy Dale Palmer and Teresa Palmer, v. ASARCO Incorporated, Inc., et al. Mr. Gravel was retained to conduct a historical investigation and render opinions on mining and milling techniques; the role and influence of the federal government on mining activities and methods; whether chat, tailings and other mining by-products were/are saleable products that possess commercial value; and the state of knowledge regarding the toxic effects of lead in chat, tailings and surface dust.

Trenton Herd et al. v. ASARCO Incorporated, Inc., et al. Mr. Gravel acted as a Rule 30(b)(6) witness, testifying as a company representative. In this capacity, Mr. Gravel provided testimony in several areas related to historical mining operations and practices on both restricted and unrestricted Indian lands located in Ottawa County, Oklahoma, from the 1890s.

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Forensic History and Environmental Cost Analysis

Working on behalf of a Fortune 500 pharmaceutical company addressing chlorinated solvent contamination in groundwater at a site in New Jersey, Mr. Gravel directed an investigation evaluating potential sources of solvent contamination. A portion of this work involved identifying hundreds of potential contributors and researching in detail the industrial operations of several dozen entities across multiple industrial sectors in order to determine their actual or potential contribution to solvent contamination in the subject area.

Working on behalf of four Fortune 500 companies, Mr. Gravel directed a PRP investigation, the development of a response costs claim package and a cost allocation for a contaminated groundwater site located in Southern California. The cost allocation was presented to a mediator and was used to support settlement negotiations among the parties involved at the site.

Working on behalf of a major communications industry client, Mr. Gravel directed both the analysis of facility operations and the development of a response costs claim package supporting a CERCLA cost recovery claim of over \$100 million for a nuclear waste cleanup site. The work involved documenting historical facility operations and cleanup activities; assessing the appropriate response costs to be claimed (consistent with the NCP); documenting claimed costs both at the summary and detail levels; developing a proposed cost allocation between the parties; and supporting settlement negotiations between the client and the U.S. Department of Justice.

Working on behalf of a petroleum industry client, Mr. Gravel directed a federal-government-involvement project, encompassing eight facilities. The work included determining the extent to which the federal government was involved in the construction and/or operations of the facilities during World War I, World War II, the Korean War; establishing the historical fact basis and federal nexus for each site; overseeing the development of past and future remedial cost estimates; validating response costs for the claim; ensuring claimed costs were consistent with the NCP for cost recovery purposes; developing a cost allocation using time-temporal and production-weighted approaches; and assisting with claims preparation and negotiations between the client and federal government.

Working on behalf of a multi-national media company addressing chlorinated solvent contamination in groundwater at a site in Alabama, Mr. Gravel directed an investigation evaluating potential sources of solvent contamination. This work involved evaluating the client's potential contribution, as well as identifying over a dozen other commercial and industrial contributors operating across multiple industrial sectors in order to determine their actual or potential contribution to solvent contamination in the subject area.

Working on behalf of the Debtor in the bankruptcy context, Mr. Gravel acted as one of project team's key leaders performing environmental claims (response costs and NRD) estimation for a matter that involved claims exceeding \$6 billion. Mr. Gravel's primary work on this matter involved managing the case team and acting as liaison between Debtor's Counsel, Debtor and outside Counsel; conducting analysis of NRD claims; conducting analysis and developing debtor cost share percentages for specific sites; assisting in the development of expert and rebuttal reports; and supporting the testifying experts.

Working on behalf of a PRP Group, Mr. Gravel managed the execution of an investigation focused on the identification of PRPs contributing to sediment contamination on a waterway located in the Midwest. The work performed related to an NRD claim brought by federal and state NRD trustees, including the U.S. Fish and Wildlife Service and the State of Ohio. Mr. Gravel developed and executed a research plan that documented the contribution of a number of parties to the contamination present in the sediments and assisted in obtaining information of use in conducting a baseline determination to support a habitat equivalency analysis ("HEA"). He also documented the nexus of a number of entities that operated on, or in close proximity to, the waterway by examining various contaminant pathways relating to specific historical operations. Mr. Gravel also assisted in developing of a cost allocation framework to facilitate settlement among the performing party group.

Working on behalf of a joint defense group, Mr. Gravel developed and executed a work plan aimed at identifying contributors to trichloroethylene ("TCE") contamination in a groundwater plume located in California. Mr. Gravel worked with Common Counsel to establish and execute a work plan that examined a number of industries and specific industrial plants in an attempt to document both the use of TCE by the target entities and specific releases or operations practices that may have resulted in contributions to the contamination by these entities. Research involved a review of federal,

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state and local records and records related to both specific target entities and certain manufacturing processes employed by those entities.

Working on behalf of a PRP Group, Mr. Gravel managed the execution of an investigation focused on the identification of PRPs contributing to sediment contamination on a waterway in the northwestern United States. Mr. Gravel developed and executed a research plan that documented the contribution of a number of parties to the contamination. His emphasis involved documenting the operations of a number of federal entities on the waterway and developing nexus packages for certain federal entities. He was also involved in initial efforts aimed at examining cost allocation issues and securing the participation of the federal entities through the U.S. Department of Justice. Working on behalf of a large manufacturing client, Mr. Gravel developed a work plan and managed the execution of an extensive PRP investigation aimed at identifying parties that contributed to PCB contamination of a waterway in the Midwest. He directed an investigation examined a number of industries and entities and provided Counsel with detailed information on a number of parties. The investigation focused on a number of specific issues, such as the historical use of PCBs by specific entities in specific processes or equipment. Research included federal and state repositories, historical societies, local repositories and specialized private and industrial collections.

Working on behalf of Dade County, Florida, Mr. Gravel acted as a consulting expert in support of a cost recovery action against the U.S. government for TCE contamination at Miami International Airport. Mr. Gravel assisted Counsel with developing and implementing a discovery plan; managed the execution of a research effort aimed at documenting U.S. government involvement at Miami International Airport over time; interviewed and assisted with witness preparation for trial; provided research and related support to expert witnesses; and provided assistance with the development of trial exhibits and other materials.

Working on behalf of a large private manufacturing client, Mr. Gravel developed and executed a work plan aimed at identifying contributors to the contamination of a river located in New England. Mr. Gravel worked with Counsel, examining a number of industries and specific industrial plants along the river to document the potential contribution of these plants to PCB and other contamination. Research involved the review of federal, state and local records and records relating to specific entities located along the river as well as certain manufacturing processes employed by those entities.

Working on behalf of a PRP Group, Mr. Gravel managed the execution of a PRP search involving a large multi-parcel, multi-use landfill site located in the Midwest. Mr. Gravel and his team conducted historical research and interviewed witnesses in order to develop a baseline historical operations report for the sites and to identify generator and transporter PRPs. Mr. Gravel also supervised the development of a transactional database, based on manifests, invoices and other data, which was used as the basis for developing an interim cost allocation; he coordinated the establishment of a document repository to house the Group's records related to the sites; and he worked with the Group on other related allocation process and investigations issues.

Working on behalf of a major transportation company, Mr. Gravel managed a PRP investigation, involving an oil recycling facility that operated from approximately 1950 to 1965. The work performed involved directing research into National Archives military records, state and local agency records, historical society archival sources, library records, and other repositories. He identified several PRPs and witnesses not previously named by the USEPA. He also directed a witness location and interview process to obtain oral histories. In addition, he compiled volumetric information from transactional data and examined waste volume ratios between federal entities and private parties in support of cost allocation efforts.

Working on behalf of a major U.S. energy provider, Mr. Gravel managed the execution of a PRP search for a waterway in New York. The work performed involved developing a historical research and investigation work plan, overseeing research at federal, state, local and private repositories, identifying PRPs, conducting waste stream analysis, managing witness identification and location, and interviewing and developing PRP profiles to be presented to the USEPA on behalf of the client. Mr. Gravel also oversaw the development of a database that included PRP profiles as well as waste-in data that ultimately will be used to apportion responsibility among parties on the waterway.

Working on behalf of a joint defense group composed of electric utility companies, Mr. Gravel managed the execution of several research efforts aimed at assisting the Group with the collection of EPA and Congressional materials related to the development, implementation and enforcement of the Clean Air Act, and, specifically New Source Review (NSR). The work involved commenting on the method proposed by EPA for producing documents responsive to the defendant's

A.J Gravel, Senior Managing Director

discovery requests and conducting research in various archives and Federal and State government repositories to assist with the documentation of the program's history and implementation and the Federal government's role in its development and enforcement.

A.J Gravel, Senior Managing Director

PUBLICATIONS

Lisa Walsh and A.J. Gravel, A. "Quantifying Environmental Liabilities in the Bankruptcy Context," *Pratt's Journal of Bankruptcy Law*, February/March 2009.

Bookspan, S., Corley, J., Gravel, A.J., 2015. "Site History: The First Tool of the Environmental Forensics Team," in *Introduction to Environmental Forensics*, Academic Press.

Bookspan, S., Corley, J., Gravel, A.J., 2015. "Essential Historical Research Methods and Their Application to Environmental Forensics." in *Introduction to Environmental Forensics*, Academic Press.

"WWII, Forensic History and Righting Environmental Wrongs," *Law360*, June 6, 2014

EXHIBIT B-2

LVS PETROLEUM ADMINISTRATION FOR WAR
J. A. KRUG, Administrator, March 18, 1946 to May 8, 1946
HAROLD L. ICKES, Administrator, May 28, 1941 to February 15, 1946

RALPH K. DAVIES, Deputy Administrator

A HISTORY OF THE
**Petroleum Administration
for War**

1941 • 1945



Prepared under the direction and editorship of

John W. Frey and H. Chandler Ide



United States Government Printing Office • Washington: 1946

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. Price \$3.00 (cloth)

CHAPTER I

The Story of Partnership

OIL FOR WAR—A PROBLEM IN SUPPLY

On May 28, 1941, a new Federal agency came into being, dedicated to the proposition that cooperation, rather than coercion, was the formula by which the forces of Government and industry could best be joined in the service of the Nation.

This is the story of the four-and-a-half-year experiment that grew out of that proposition. It is the story of a partnership: On the one hand, the Petroleum Administrator for War,¹ precedent-maker in the extent to which it relied upon the industry it directed. On the other hand, the Petroleum Industry War Council, the Foreign Operations Committee, and the District Committees, were precedent-breakers in the extent to which they joined forces in support of Federal officialdom.

Together, they set about to translate into reality the wartime-popular expression: "The difficult we do immediately; the impossible takes a little longer."

Well it was that they set themselves this challenge. Well it was that they met it so competently. For World War II, from beginning to end, was a war of oil.

Almost seven billion barrels of it had to be brought from the ground between December 1941 and August 1945, to meet the requirements of the United States and its Allies, and nearly 6 billion of this enormous total came from the United States. That is *one-*

fifth of all the oil that had been produced in this country since the birth of the industry in 1859.

A staggering output, to be sure, but the prodigious thirst of the war machine could not be satisfied with less, for oil was *the* indispensable material.

It constituted *more than half* of all the tonnage of supplies that were shipped overseas. In several invasions, its tonnage was *more than 65 percent* of the total.

Incredible? Not to the men who had to supply it. Not—especially—to the men who had to use it. For oil did more than fuel and lubricate the ships and the airplanes and the motorized ground equipment. Oil was also heat and light and comfort and mercy. Out in the field, in the form of gasoline, it fueled the kitchens, it powered the radios and telephones, it warmed and illuminated the hospitals, it refrigerated the life-saving blood plasma, it heated the instrument sterilizers, it ran signal devices, water purification systems, and repair machinery. From oil came the toluene for TNT that went into bombs, the asphalt for airfields, the jellied gasoline for flame throwers, the kerosene for smoke screens, the wax for packaging food and equipment, the petroleum coke for aluminum.

More than 500 different petroleum products were regularly used by the armed services. Without them, the warrior could neither fight nor live. With them, we were able to live and fight—and win.

That is what was in the mind of Charles E. Wilson, executive vice chairman of the War Production Board, when he commented during the days of late 1943:

The responsibility which rests upon the petroleum industry and the Petroleum Administration for War is a dramatic one, for it is nothing less than the responsibility for victory.

Meeting that responsibility was a back-breaking task, an around-the-clock task, a task world-wide in scope and bewildering in its complexities. For everywhere that men were fighting, or massing to fight, or

¹ As created originally, the oil agency was "The Office of Petroleum Coordinator for National Defense." After the beginning of hostilities, it became the "Office of Petroleum Coordinator for War." On December 2, 1942, its authority was strengthened and it became the "Petroleum Administration for War." However, in the interest of simplicity, the final designation will be used throughout this book, except in chapters III and IV, which deal with the evolution of the organization.

training to fight, or making the wherewithal with which the fighting was done—*there* oil was, and *there* oil served.

Like the men whose comrade in battle it was, oil came from the earth's corners: from 20 allied, neutral, and liberated countries on 5 continents. And like the men, it had to be moved to the numberless places where jobs were to be done: moved by pipe-line, by tank car, by barge, by truck, by tankers, to hundreds of refineries, from the simple "tea kettle" to the catalytic skyscraper; broken down by heat and pressure and chemical magic and put together again in forms that man never conjured before; and hustled away to fuel a truck or a factory, to join an invasion or bombing mission, to plunge into Germany or to raid the China Sea. So that oil might fulfill this many-sided destiny, the Government-industry oil team brought about these concrete achievements:

Drilled a total of 13,400 wildcat wells, more than in any like period in history.

Increased crude oil production in the United States by more than 44,000,000 gallons daily, or 27 percent more than this greatest of oil-using nations produced in 1941.

Carried through a continuing program of adjusting refinery operations so as to produce the required yields of required products.

Increased refinery runs in the United States by more than 1,400,000 barrels daily. That equals more than 47,800,000 gallons every day, an increase of 30 percent over 1941.

Sponsored and administered a billion-dollar plant construction program for 100-octane aviation gasoline.

Increased foreign production by 61 percent and foreign refinery runs by 40 percent.

Improvised a virtual miracle by putting together with incredible speed an overland transportation system to replace the ocean tankers that had gone to war. This involved building, relaying or reversing 17,684 miles of pipe line and rearranging barge movements on inland waterways, and mobilizing 75,000 tank cars to serve the east coast.

Produced in the United States an estimated 13½ trillion cubic feet of natural gas, equivalent in heat value to more than 2 billion barrels of oil.

Despite all losses, increased the United States tanker fleet three times in total tonnage.

Saved millions of tons of steel and other critical materials through pooled operations and more efficient use of available supplies.

Integrated worldwide oil operations into a United Nations program which assured most effective utilization of facilities and resources.

Supplied the essential civilian requirements for petroleum products while meeting every demand of the armed forces *in full and on time*.

When the Japanese surrender signalized the end of the war, the oil team of Government and industry received the only recognition that it wanted or expected—the verdict of the Services: "Well done."

The Army-Navy Petroleum Board of the Joint Chiefs of Staff said it in words that will always be remembered by the men concerned:

* * * at no time did the Services lack for oil in the proper quantities, in the proper kinds and at the proper places * * * No Government agency and no branch of American industry achieved a prouder war record.

Warming words, indeed—words that proved that the struggles were worth while. But, the struggles were real, nonetheless. There were never enough men. There were never enough materials. There was never enough time. There was always a plethora of obstacles.

Only by teamwork, by long hours, by refusal to yield to discouraging odds, were these obstacles overcome. The dominating purpose of the concerted efforts was the supplying of petroleum products of the kinds needed, in the amounts needed, at the places needed to win the war.

TEAMWORK STARTS IN PRE-WAR 1941

In considering this teamwork, it is frequently difficult to distinguish between the activities of PAW on the one hand, and the industry committees on the other. So closely and continuously did they work together, that it is often all but impossible to say where one left off and the other began, or even which one did begin and which one finished. Of course, in another sense, the functions and responsibilities of the two partners were quite separate and distinct. For, it was always the role of Government to determine plans and policies, to direct and supervise operations requisite to their fulfillment, and to assume over-all governmental responsibility for all aspects of the oil program.

The functions of each are described in chapters III, IV, and V, but it may be pointed out here that PAW, of course, did not find, or produce, or refine, or transport a single barrel of oil. Rather, by the terms of

EXHIBIT B-3

WARTIME PETROLEUM POLICY UNDER THE PETROLEUM ADMINISTRATION FOR WAR

HEARINGS

BEFORE A

SPECIAL COMMITTEE INVESTIGATING
PETROLEUM RESOURCES

UNITED STATES SENATE
SEVENTY-NINTH CONGRESS

FIRST SESSION

PURSUANT TO

S. Res. 36

(Extending S. Res. 253, 78th Congress)

A RESOLUTION PROVIDING FOR AN INVESTIGATION
WITH RESPECT TO PETROLEUM RESOURCES IN
RELATION TO THE NATIONAL WELFARE

NOVEMBER 28, 29, AND 30, 1945

Printed for the use of the
Special Committee Investigating Petroleum Resources



would amount to a subsidy to that operator over and above his competitors?

Mr. FRAME. I, of course, am fundamentally opposed to subsidies.

Mr. FRASER. So there might come a point where it was better to forget the whole episode?

Mr. FRAME. That point certainly could arrive.

Mr. BATZELL. In that connection the Government has an investment in these plants. It might be advisable to forget the whole episode, but to the extent that any of those facilities have usable value or are usable in the production of postwar aviation gasoline and motor gasoline, it would seem to me it would be in the Government's interest to see that the facilities were put into operation even though in disposing of the facilities it had to take a loss on the actual cost involved. Would you concur in that opinion?

Mr. FRAME. I don't think I am going to get mixed up in the middle of that dog fight.

Mr. FRASER. As a result of your experience, Mr. Frame, do you have any squints toward the future that you would like to take?

Mr. FRAME. Judging from the results achieved during the war—and again I come back to aviation gasoline, an industry which was able to do what most refining technicians prior to the war would have said was impossible, and that is, to increase the production of aviation gasoline many times—I would say that any action which could preserve the industry in good standing during the war should again be able to serve us in good stead if an emergency arises in the future.

Senator MOORE. Thank you very much, Mr. Frame.

(The prepared statement of A. P. Frame is as follows:)

PETROLEUM REFINING IN THE UNITED STATES DURING THE WAR

By A. P. Frame, Director of Refining Division, Petroleum Administration for War, Washington, D. C.

INTRODUCTION

The refining industry is the manufacturing branch of the petroleum industry. It is in the refinery that crude oil is converted into its many useful products.

Crude oil is composed of many hundreds of distinct chemical compounds which, although similar in chemical make-up, differ in such characteristics as boiling range, solidifying point, etc. Frequently, also, crude oil is contaminated by such undesirable products as sulfur compounds which if not removed in the refining process, would impart injurious quality to the finished product.

Originally the refining of crude petroleum was a simple process. It consisted of heating the crude oil in a vessel and collecting and condensing the vapors as the temperature of the oil was raised. The first material to be distilled was segregated as gasoline, with kerosene and gas-enrichment oil following successively. The residue remaining in the still was either further processed for the production of lubricating oils or sold directly as a residual fuel oil product. The simplicity of this type of operation is best indicated by the name given to these early stills which were known as "cheese box" stills. The still was cylindrical and mounted on a brick fire box and looked like an overgrown cheese box.

The refining industry has progressed very rapidly in the relatively few years since the "cheese box" still was in use. Today refining is carried out in equipment which in some cases is as high as a 20-story building, consisting of a veritable maze of pipes, towers, furnaces, and pumps.

For the purpose of this discussion and in order that the lessons of history may be applied to forecasting the future, the story of refining will be presented in two phases. First is presented a brief summary of the development of petroleum

refining from its inception to the outbreak of World War II, following which is a summary of developments in the refining industry during the war period.

DEVELOPMENT OF PETROLEUM REFINING

As indicated on chart No. 18 entitled "Gasoline and Fuel Oils Supplant Kerosene," crude oil runs to stills in the whole country in the year 1899 amounted to 142,000 barrels daily. These crude runs increased almost every year until in 1941 they averaged 3,861,000 barrels daily, an increase of over 2,500 percent—truly an amazing growth—and yet this figure does not tell the whole story.

In 1899 the production of gasoline from crude oil amounted to some 18,000 barrels daily or approximately 13 percent of the crude oil run. In 1941 the gasoline production amounted to 1,703,000 barrels daily or slightly over 44 percent of the crude processed. A further illustration of the changes in the refining industry is that in 1899, 82,000 barrels daily or almost 60 percent of the volume of the crude run was kerosene. In contrast, in 1941 kerosene production was 201,000 barrels daily or slightly over 5 percent of the crude run. These figures indicate clearly the broad changes that have taken place in the national economy in a period of just over 40 years since the turn of the century.

Originally crude oil was valued primarily for the production of kerosene and for lubricating oils, but with the development of the automobile the emphasis shifted to the production of gasoline. This change in emphasis caused the refining industry to develop from a simple operation into one of the most complex of the processing industries. Crude oil contains on the average from 20 to 25 percent of a product boiling within the gasoline range. Fortunately, petroleum technologists discovered that it was possible, by subjecting the heavier portions of the crude oil to high temperatures and pressures, to convert part of this heavy material into gasoline with fuel oil as a byproduct. This operation, known in the industry as cracking, has made it possible to triple and more than triple the amount of gasoline produced from crude oil. It was the development of this art of cracking that made it possible to supply the ever-mounting demands for motor fuel.

HIGHER QUALITY AT LOWER COST

An equally outstanding development in the refining industry up to the time of Pearl Harbor was the continual improvement in the quality of gasoline, particularly with reference to its antiknock properties. Most gasoline obtained from crude oil directly by distillation has a relatively low antiknock property. Fortunately, the gasoline produced by cracking has in general a higher octane number than the straight-run gasoline, and petroleum technologists soon found that by increasing the severity of the cracking reaction a still further improvement could be obtained. Consequently, for many years prior to the war the refining industry produced each year a higher-quality motor fuel. To do this the industry built increasingly complicated and costly cracking units and resorted to the use of additional agents, particularly tetraethyl lead.

It is a matter of history that during the 1930's a higher-quality gasoline was being manufactured than the currently produced automobiles required. However, it is also a matter of history that the automotive engineers were thus able to design future models to take advantage of the higher-quality fuel available and thus to improve the performance and efficiency of the car. While the quality of the gasoline was being improved, moreover, the price went steadily downward. In other words, for many years motor fuel of higher and higher quality was made available at a lower and lower price.

Similar improvement in quality and lowering of price took place with respect to the other products of the refineries during the prewar period, such as lubricating oils and greases, and the period witnessed a striking development of specialty products such as insecticides and waxes, and the production of chemicals from petroleum, such as alcohols and toluene.

BIRD'S-EYE VIEW OF PREWAR REFINING

In summary, here is a picture of the petroleum refining industry as it existed prior to the outbreak of the war.

It was a highly developed, highly competitive industry which had enjoyed an ever-increasing volume of business for many years and which, in return for this increased volume, had been supplying products to the public with constantly improved quality at lower and lower costs.

It was an industry which was spending millions of dollars annually for the development of new and improved products. As one of the results of this search for higher quality it had developed alkylation processes which later provided the very heart of 100-octane aviation gasoline.

It had developed catalytic cracking without which it would have been impossible to produce the volumes of aviation gasoline later required.

It had developed other processes and products in an effort to maintain the competitive position of the individual companies and without which developments the progress of the war would have been seriously impeded.

It was an industry of approximately 400 refineries scattered across the country ranging in size from as low as 50-barrels-a-day capacity to well over 100,000-barrels-a-day capacity.

It was an industry which, because of the demand for ever-improved product quality, was necessarily building bigger, more complicated, and more expensive processing units. As the required capital investment per unit of capacity increased, the economic advantage of larger units became correspondingly greater, narrowing the advantage the small refiner had previously enjoyed due to transportation or other savings.

It was a virile industry and, fortunately for this country, able and willing to meet the demands soon to be thrust on it by the war.

WARTIME GOVERNMENT ACTION

The responsibilities of PAW and its predecessor, the Office of Petroleum Coordinator, with respect to the domestic refining industry were (1) to direct the activities of all domestic refineries so as to obtain essential petroleum requirements, both military and civilian, and (2) to spark the drive for the construction of necessary new refining facilities. As a matter of good faith and public policy PAW attempted, in discharging its responsibilities, to disturb as little as war conditions would permit the competitive positions previously held by the various companies in the refining industry.

In May 1942 the first Government action affecting the whole refining industry was taken. At that time a program for the operation of refineries as to their crude runs and product yields was formulated in order to balance crude-oil supplies and available transportation with military and essential civilian requirements. The cooperation of the industry with this program was gratifyingly prompt and effective, and was in no small measure responsible for averting what might easily have been a catastrophic situation in regard to the availability of petroleum products, particularly in the Atlantic seaboard area.

WARTIME PROBLEMS

When war broke out the future of the refining industry was full of unknowns. Normal methods of transporting crude and products were soon radically changed. Future military requirements for petroleum products were indefinite. For instance, the initial goal for 100-octane gasoline was set at 120,000 barrels per day late in 1941, a staggering figure considering that the production at that time was somewhat less than 40,000 barrels per day. Three years later the requirement for 100-octane gasoline was set at over 600,000 barrels per day. Even the requirements for essential civilian products were not accurately known, and the whole future appeared to be nothing but a series of question marks.

INDUSTRY COOPERATION

Both the industry and PAW recognized that only by the closest cooperation of everybody concerned could the future demands be met. At the request of PAW, companies made available to PAW and to their competitors their most cherished secrets of technical know-how. They pooled their facilities, their technical information, and their products, and under PAW direction ran their refining activities as if they were component parts of one huge refinery. With such cooperation, production of petroleum products reached levels never before attained—levels without which the war might have been greatly prolonged.

WARTIME OPERATIONS

On chart No. 19, entitled "Wartime Refinery Operations," is shown graphically the average daily crude runs to refineries during the war period. In 1941 crude runs to stills averaged 3,861,000 barrels per day. During August 1945 crude runs

to domestic refineries averaged 5,100,000 barrels per day, an increase of 32 percent. This increase in crude runs was mainly effected by making the maximum use of facilities which existed prior to the war. The refining industry already had almost sufficient crude processing capacity to meet total war requirements—in fact, only 2 completely new refineries were constructed during the war.

There was need, however, for new and special equipment to vary the proportions in which the several products could be made and to make new and special products in quantities and qualities unobtainable with prewar facilities. The construction of these new process units to provide the special products needed in the war program will be discussed in detail later.

In the second quarter of 1942, as indicated on the chart, crude runs reached a low of 3,486,000 barrels per day. This reduction in crude runs was necessitated by the complete dislocation of the normal transportation system as a result of submarine warfare and the diversion of tankers to military use.

Chart No. 20, entitled "War Changes in Refinery Runs—By Areas," shows the changes in crude runs brought about by the war in each of the five PAW districts. The comparison here is between daily crude runs in 1938 and in 1945. As may be seen from this chart, the increase was fairly equally distributed in all districts rather than concentrated in any one area.

CHANGES IN PRODUCTS AND QUALITY

During the war period not only was it necessary to change crude runs but it was also necessary to make rather radical changes in the ratio of products yielded. On chart No. 19 is shown the daily barrels of total gasoline, kerosene, light fuel oils, and heavy fuel oils produced during the years 1938 to 1945.

Civilian motor gasoline was reduced by rationing, reaching its low point in the year 1943, while total gasoline, including aviation gasoline, increased steadily for each of the war years. The production of kerosene and light fuel oils increased during each of the war years, but despite this increase it was necessary to ration the civilian use of these products in order that the military requirements for Diesel fuel could be met. The production of heavy fuels showed a marked increase during the war period, reflecting the increasing tempo of the Pacific war. It has been aptly said that the European war was a gasoline war and that the Pacific war was a fuel-oil war, and the chart graphically bears out the truth of that statement.

Although, as has been shown, both crude throughputs and product yields were affected by wartime requirements, the greatest effect might best be classed as changes in product quality. Among the products so affected were the residual fuel oils, due primarily to the Navy's requirements for tremendous quantities of low-viscosity fuel oil; Diesel fuels, also due to large Navy requirements; aviation-grade lubricating oils; and aviation gasoline. There were many other quality changes covering specialty products, such as jellied gasoline for incendiary bombs, fuel for flame throwers, waterproofing compounds, and other similar products, but volumewise these specialties were not of major importance.

AVIATION GASOLINE

The wartime record of the petroleum refining industry in the production of aviation gasoline is an outstanding one. Chart No. 21, entitled "100-Octane Aviation Fuel," shows the daily world-wide production of 100-octane aviation gasoline, by months, from the beginning of 1942 until the end of hostilities in 1945.

In January 1942 the world-wide production of 100-octane gasoline averaged about 73,000 barrels per day, of which 55,000 barrels per day was produced in the United States. In July 1945 the average world-wide daily production was almost 600,000 barrels, of which 523,000 barrels were produced in this country. This tremendous increase in 100-octane production was primarily the result of excellent industry-Government cooperation.

One hundred-octane aviation gasoline is a tailor-made product. Its manufacture is not a case of merely stepping up the quality of motor gasoline but instead requires the manufacture of such highly technical components as alkylate, isopentane, cumene, base stock, etc., the blending of these components in the proper proportions, and the addition of the proper quantity of tetraethyl lead. The resulting fuel must meet the very rigid specifications set by the military. The manufacture of the components in most cases requires complicated and expensive

WARTIME PETROLEUM POLICY

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refinery processing units, few of which were in existence prior to the war. Industry and Government spent a total of nearly a billion dollars in the construction of such facilities during the war years.

SOURCES OF PRODUCTION

An examination of the sources of production of 100-octane gasoline as indicated on chart No. 21, is of interest. In the first 6 months of 1945, out of a total world-wide average daily production of 575,000 barrels, approximately 505,000 barrels were produced in the United States and 70,000 barrels in foreign countries.

Of the United States total, 337,000 barrels per day were produced from facilities constructed during the war, 56,000 barrels per day from facilities constructed prior to the war, and 30,000 barrels per day by the relaxation of certain specifications. The balance of 82,000 barrels per day was obtained through the ingenuity and resourcefulness of everybody concerned in the aviation gasoline program. It was obtained by modifying existing facilities, by the development and use of new blending agents, by increasing the capacity of existing facilities through the removal of bottlenecks, by the complete interchange of production know-how between companies, and by many other steps, all of which contributed to the increase in production.

It should be observed that whereas the production from new facilities did not reach a significant amount until the last quarter of 1943, the production attributable to ingenuity and resourcefulness had reached an appreciable figure in the last quarter of 1942 and maintained its importance right through to the end of the war period. Without this production the military requirements for 100-octane gasoline could not have been met.

REIMBURSEMENT AND PLANNED BLENDING

An important factor in making it possible for the refiners to exercise their ingenuity and resourcefulness in increasing the production of 100-octane gasoline was the aviation gasoline reimbursement plan. This plan provided a mechanism by which the refiners, with the approval of PAW, could alter their normal operations in order to increase the production of aviation gasoline and later could recoup their actual losses by submission of claims to the Reconstruction Finance Corporation, which claims were audited and approved by PAW. The operation of this plan was most successful in achieving its purpose of increased production.

Another factor which contributed materially to the production of 100-octane gasoline was the planned blending technique designed and operated by PAW. Under this plan all refineries producing 100-octane gasoline or its components were considered as parts of one gigantic refinery. Components were shipped from one refinery to another, and each refinery was operated in such a manner that its production of 100-octane components fitted into the over-all plan without regard to the effect on its individual production. This centralized control permitted the maximum efficient use of all components and added many thousands of barrels daily to the production of 100-octane gasoline.

RESULTS OF TEAMWORK

Industry committees, such as the Aviation Gasoline Advisory Committee and the Technical Advisory Committee, held national and district meetings at which technical and operating developments were freely discussed. Technical subcommittees of the industry collected and analyzed operating data and presented to the industry recommendations and suggestions which were invaluable in maintaining and increasing production of 100-octane gasoline and its components. In addition, the petroleum refining engineering firms gave freely of their knowledge and manpower to increase the production of aviation gasoline. The whole program of aviation gasoline was an example of what teamwork can accomplish.

TETRAETHYL LEAD

As a further interesting example of the functions of PAW during the war period, chart No. 22, entitled "Tetraethyl Lead," is presented. This chart shows the production, consumption, and inventory of tetraethyl lead during the war period.

Tetraethyl lead is manufactured at two plants in the United States. Its manu-

ing aviation gasoline, are dependent on it to meet quality specifications. In the early stages of the war about 23 percent of the tetraethyl lead produced was used in military gasoline, while the balance went into civilian gasolines and into stocks. This situation progressively reversed itself until, at the peak of the military use, about 80 percent of the production went into military gasoline and 20 percent to civilian use.

Early in 1943, arrangements were made to increase the manufacturing facilities for tetraethyl lead to nearly double the prewar capacity. At about the same time it became evident that civilian use of tetraethyl lead would have to be rigidly restricted if military requirements were to be met and adequate stocks for military security were to be accumulated. Accordingly, in November 1943 a ceiling of 76 octane number was placed on premium gasoline and a ceiling of 72 octane number on house-brand gasoline. In June 1944 it was necessary further to restrict the civilian use of tetraethyl lead by limiting the percentage of premium gasoline that any refiner might manufacture, and in July 1944 it was necessary to reduce the octane number of house-brand gasoline from 72 to 70. These steps degraded civilian gasoline and limited the production of premium gasoline below the most efficient level, but they permitted the accumulation of a strategic storage reserve of this product so essential for military use.

NEW REFINING INSTALLATIONS

As previously mentioned, it was necessary during the war to expend vast sums of money in petroleum refining facilities in order to provide the aviation gasoline and other military products required. Only a limited amount of these expenditures was for the purpose of increasing the crude-oil capacity of refineries. Practically all the expenditures were for installations to make the necessary product quality. The effect of these expenditures was to enable the industry to meet military demands for aviation gasoline and other high-quality products, but most of the facilities so constructed have a postwar use and will undoubtedly exert a profound influence on the industry in the years ahead.

During the war years a total of \$927,000,000 was expended on major projects in the refineries of the United States, exclusive of the expenditures in refineries for the production of toluene for explosives and butadiene for synthetic rubber. Of this total amount, \$864,000,000 was spent on facilities for the production of 100-octane aviation gasoline, \$27,000,000 on facilities for the production of high-quality lubricating oils, and \$36,000,000 for such miscellaneous projects as additional steam and power generating units, facilities for running "sour" crude, coking units, etc. Approximately \$694,000,000 of the total, or 75 percent, was expended by the industry for facilities owned and operated by the industry itself, and \$233,000,000 was expended by the Government for Government-owned facilities which were leased and operated by the industry.

All the expenditures for lubricating oil facilities and for miscellaneous facilities were for privately owned and operated installations. Of the \$864,000,000 spent for 100-octane facilities, \$631,000,000, or 73 percent, was for privately owned and operated facilities, and \$233,000,000, or 27 percent, was for Government-owned and industry-operated facilities. Most of the Government-financed facilities were installed at refineries belonging to smaller companies having limited financial resources, thus aiding those companies to participate in the program instead of concentrating it all in the hands of the larger companies. The Government encouraged the private investment in new refining facilities through loans and accelerated tax amortization certificates, both of which were effective in enabling industry to make the necessary investments.

Of the facilities installed for the production of aviation gasoline, the installation of catalytic cracking units accounted for the biggest part of the cost; next came the installation of alkylation facilities; and third, such miscellaneous units as butane isomerization units, fractionating units, etc.

The art of catalytic cracking on a commercial basis was developed prior to the war but on a very limited scale. Today, due to the war, there are in this country catalytic cracking units having a total charging capacity of over 1,000,000 barrels a day. Nearly all these units were built to produce high-quality base stocks and feed stocks for alkylation units for ultimate use in 100-octane aviation gasoline. These same units, however, can be used for the production of high-quality motor gasoline, and it is a reasonable assumption that most of them will be so used.

The situation in regard to alkylation units is quite different. In alkylation units, isobutane is combined chemically with butylene to produce alkylate, which is fundamentally the iso-octane originally used as the ultimate in the octane

number scale. Alkylate in general is a relatively expensive commodity to produce, and only in rare cases is it economically feasible to include it in such a low-price product as motor gasoline. Therefore, it is a reasonable assumption that many of the alkylation units constructed during the war will have little if any postwar value.

Of the third or miscellaneous group of units, a portion of them probably will continue to be used, but such facilities as butane isomerization units have little indicated postwar value.

STATUS OF REFINING INDUSTRY ON VJ-DAY

In summary, this is a picture of the petroleum refining industry as hostilities ceased on August 14, 1945.

It had increased its crude runs by over a million barrels a day, mainly through facilities which had been built prior to the war.

It had increased its production of 100-octane aviation gasoline from 55,000 to 525,000 barrels a day.

It had met every demand of the military for all kinds of petroleum products.

The small refiners as well as the larger ones had been required to utilize their productive capacity to the maximum.

It had willingly pooled its technical know-how, its operating experience, and even its products for the common good.

It had in effect been operated as if its various refineries were component parts of one huge Nation-wide refinery.

Nearly a billion dollars had been spent to provide the higher-quality products needed by the war machine.

A production record was achieved that has received high praise from military and Government leaders.

TERMINATION OF GOVERNMENT CONTROLS

Japan accepted the Allied surrender terms on August 14, 1945. On August 15 PAW advised all refineries that practically all of the Government-imposed restrictions and directives were either immediately revoked or would be within a stated period of time. Because military consumption of aviation gasoline and motor fuel dropped sharply and immediately, the orders limiting the quality of civilian gasoline and the amount of premium gasoline that could be produced were among those lifted at once. In addition to the revocation of orders, the Petroleum Administration advised all manufacturers of 100-octane gasoline to discontinue production as rapidly as possible and in no case to extend beyond a 30-day run-out period. By these actions the Petroleum Administration returned to the refining industry its right of unrestricted and independent action and thus restored the condition of free competition that existed prior to the war.

Mr. DAVIES. Mr. Chairman, turning from domestic to foreign refining, I should like now to call on Mr. C. Stribling Snodgrass, Director of Foreign Refining and chairman of the Foreign Operating Committee.

Mr. Snodgrass is a graduate of the United States Naval Academy and served 10 years in the Navy before accumulating 18 years' experience in the oil business. For a time between the wars he served in submarines.

He started in the oil business as a refinery engineer with C. F. Braun & Co. in California, and later served that company in branch office management capacities in Chicago, New York, and London.

Most of the 9 years before this war he spent in Europe as a consulting engineer. When Germany invaded Poland he was managing director of Snodgrass, Perrin & Co., Ltd., refinery engineers, with headquarters in London. He reentered the Navy in 1940, and in 1941 was transferred to PAW at our special request.

He was a member of the technical oil mission to the Middle East in 1943-44.

He will talk to you on world refining.

EXHIBIT B-4

PETROLEUM ADMINISTRATION FOR WAR

WASHINGTON, 25, D. C.

In Reply Please Refer to:
Rfg-363-SW

Mr. Carleton J. Everett,
Director of Refining, District I,
Petroleum Administration for War,
1104 Chanin Building,
122 East 42nd Street,
New York 17, New York.

NOV 6 - 1944

Dear Mr. Everett:

During the last month there has been an exchange of correspondence between the Petroleum Administration for War and the War Production Board which has, and will have, a great influence on the progress of new construction work in the Refining Industry. For your information, I am attaching hereto copies of the following letters:

- September 30, 1944 - Mr. Ralph K. Davies' letter to Mr. J. A. Krug,
Re: Refining Construction Program.
- October 19, 1944 - Mr. Ralph K. Davies' letter to Mr. J. A. Krug,
and Mr. A. P. Frame's letters to Mr. M. J. Madigan
and Rear Admiral A. F. Carter,
Re: Catalytic Cracking Construction Program.
- October 21, 1944 - Mr. J. A. Krug's letter to Mr. Ralph K. Davies in
reply to the September 30th letter.
- October 27, 1944 - Mr. Ralph K. Davies' letter to Mr. J. A. Krug,
Re: Lubricating Oil Construction Program.
- October 30, 1944 - Mr. Ralph K. Davies' letter to Mr. J. A. Krug in
reply to the October 21st letter.

The most significant document is Mr. Krug's letter of October 21st in reply to Mr. Davies' letter of September 30th. Although in the first paragraph Mr. Krug states that the War Production Board has concluded that at this time there can be no modifications of the strict standards in force for the approval of projects based on war essentiality, he then goes on to agree with us that in view of the time lag between authorization for actual completion of facilities, it is desirable to give favorable consideration to certain types of facilities sponsored by the Petroleum Administration for War. He then restates the policy expressed by Mr. C. E. Wilson to the Petroleum Board on June 24th. It would appear that



within the four numbered paragraphs practically all of the construction projects which the Petroleum Administration for War is likely to give endorsement to at the present time are included. He further indicates that some of our projects may well be approved on the basis of war-time necessity but that they may have to be given relatively low priority ratings and of course that the availability of manpower will have to be considered in all instances.

In the light of this letter and our continuing studies of Petroleum War Program requirements, we have already recommended the approval of two catalytic cracking units and seven lubricating oil plants. We anticipate that some of the other projects in the September 30th list will also be able to move forward in the near future.

All of the attached letters are being forwarded to you for your Office's information only with the exception, of course, of those portions which have already been made a part of public press releases by the Petroleum Administration for War and the War Production Board.

Sincerely yours,



Geo. L. Parkhurst
Assistant Director of Refining

Attachments